Nepean Creek 2012 Summary Report

Watershed Features	
Area	10.35 square kilometres 0.24% of the Rideau River watershed
Land Use	1% agriculture 82% urban 16% forest 1% waterbody
Surficial Geology	42% clay 26% diamicton 8% organic deposits 1% bedrock 23% sand
Watercourse Length and Type	*Total Length:* *Watercourse type:* 50% natural 50% channelized *Flow type:* 100% permanent
Invasive Species	There were seven invasive species observed by CSW staff in 2012:Chinese mystery snail, purple loosestrife, garlic mustard, zebra mussel, Manitoba maple, and buckthorn spp.
Fish Community	18 fish species have been captured on Nepean Creek. Game fish species include rock bass, smallmouth bass, largemouth bass and muskellunge

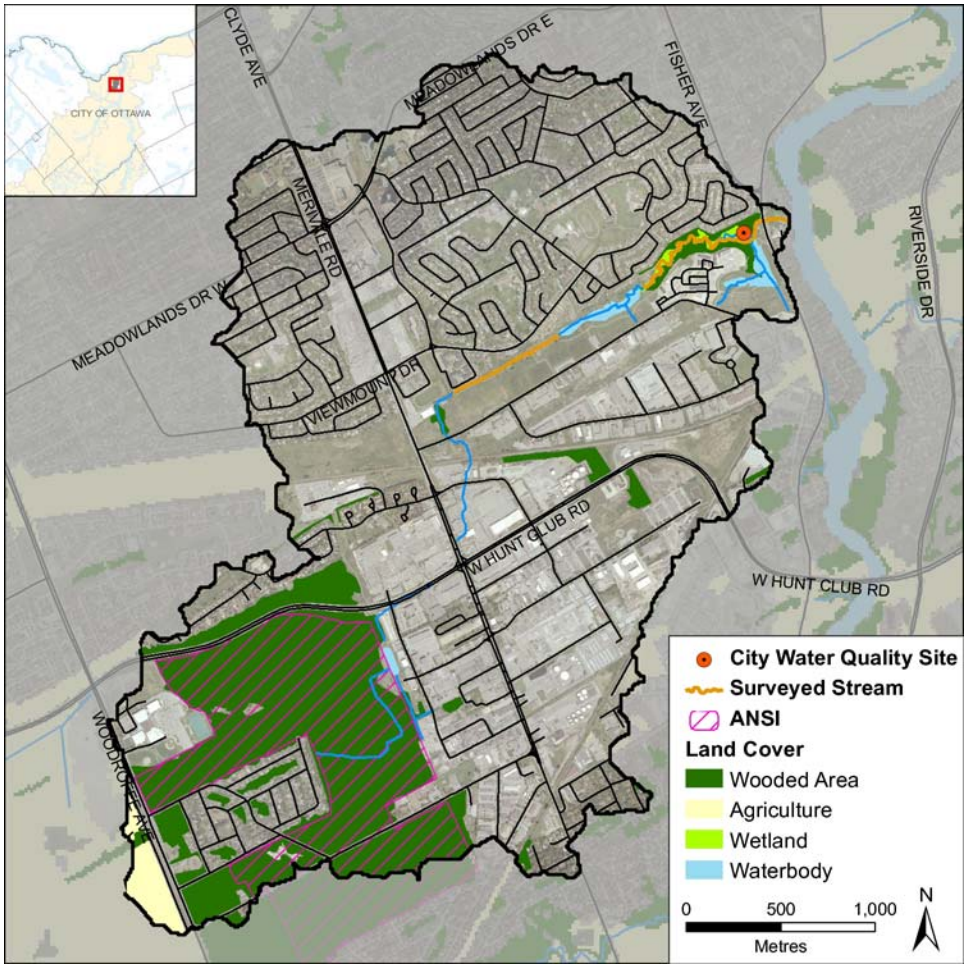

Figure 1. Land cover in the Nepean Creek catchment

Vegetation Cover		
Types	**Hectares**	**% of Cover**
Wetlands	0	0
Wooded Areas	62	36
Hedgerow	1	0
Plantation	110	64
TOTAL COVER		**100%**

Woodlot Cover		
Size Category	**Number of Woodlots**	**% of Woodlots**
<1 ha	11	3.3
1-9 ha	1	59.9
10-30 ha	12	21.9
>30 ha	1	15

Wetland Cover
0% of the watershed is wetland
Wetlands make up 0% of the vegetation cover

The Rideau Valley Conservation Authority, in partnership with seven other agencies in Ottawa (City of Ottawa, Heron Park Community Association, Ottawa Flyfishers Society, Ottawa Stewardship Council, Rideau Roundtable, National Defence HQ - Fish and Game Club, and the National Capital Commission) form the 2012 City Stream Watch collaborative.

Introduction

Nepean Creek is approximately two kilometers long (excluding the stormwater ponds) and flows from Colonnade Business Park just east of Merivale Road to the Rideau River just south of the intersection of Prince of Wales Drive and Fisher Avenue. The headwater reaches of the creek are entombed, out letting just east of Howard Darwin Centennial Arena (formally Merivale). From that point, the creek flows along the southern edge of a highly developed residential area. A naturalized buffer has been maintained between the development and the stream, and well used recreational pathways wind their way through the area crossing the creek multiple times and connecting to residential streets. Nepean Creek has an one online stormwater pond and one offline stormwater settling pond located close to the Rideau River. The stormwater ponds were not included as part of the stream survey as they fall outside the guidelines of the stream assessment protocol.

As part of the City Stream Watch monitoring activities in 2012, twenty 100 meter sections of Nepean Creek were surveyed. he following is a summary of the 20 macro-stream assessment forms completed by staff and volunteers with the City Stream Watch Program.

Low Water Conditions in the Rideau Valley Watershed

The Government of Ontario has set up the Ontario Low Water Response (OLWR), which ensures that the province is prepared for low water conditions in the future. The response plan is intended to help co-ordinate and support local response in the event of drought. Local teams are established in areas experiencing low water conditions so that the local community can carry out actions to reduce and better manage water use. As an important part of the Low Water Response Team for the watershed, the Rideau Valley Conservation Authority (RVCA) measures precipitation, stream flow and water levels which indicate the severity of low water conditions in the watershed. In 2012, the Rideau Valley Watershed was impacted by low water conditions. RVCA first declared Level 1 low water status on April 5, 2012. Level 1 status continued until July 13, 2012 when the status was increased to Level 2. On October 3, 2012 the Level 2 low water status was lifted for most of the watershed except for the Kemptville Creek subwatershed which remained at Level 1 status. This information is important to highlight as the drought impacted aquatic habitat conditions in the Rideau watershed in 2012.

Droughts are natural events that occur periodically over time. In the past, periods of dry weather and low water levels were relatively uncommon happening every decade or so. But with changing weather patterns, low water levels may occur more often, especially with increasing demand for water. It can be argued that “many species of biota, both terrestrial and aquatic, have evolved many different adaptations to contend with drought” (Humphries, 2003). However it is important to keep in mind that drought conditions can “enhance siltation, change the composition of aquatic vegetation, alter channel shape and affect water chemistry” (Lake, 2003). These changes may result in direct and indirect impacts on vegetation, fish species, invertebrates and amphibians (Lake, 2003).

Overbank Zone

Riparian Buffer along Nepean Creek

The riparian or shoreline zone is that special area where the land meets the water. Well-vegetated shorelines are critically important in protecting water quality and creating healthy aquatic habitats, lakes and rivers. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat in streams. Well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water. A recommended target (from Environment Canada’s Guideline: *How Much Habitat is Enough?*) is to maintain a minimum 30 meter wide vegetated buffer along at least 75 percent of the length of both sides of rivers, creeks and streams.
Figure 2 demonstrates the buffer conditions on Nepean Creek for the left and right banks separately. Results show that 41 percent of the left bank and 46 percent of the right bank of Nepean Creek has a buffer width greater than 30 meters.

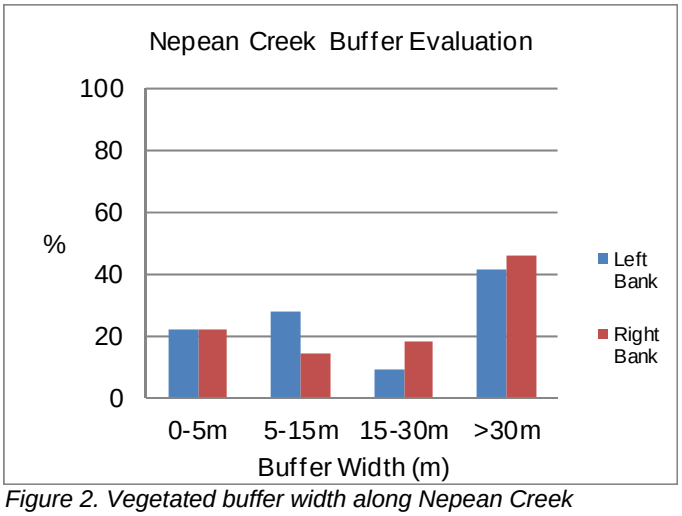

Figure 2. Vegetated buffer width along Nepean Creek

Land Use beside Nepean Creek

Figure 3 demonstrates the seven different land uses identified along the banks adjacent to Nepean Creek. Surrounding land use is considered from the beginning to end of the survey section (100 metres) and up to 100 metres on each side of the creek. Land use outside of this area is not considered for the surveys but is nonetheless part of the subwatershed and will influence the creek. Natural areas made up 43 percent of the stream, characterized by wetland, forest, scrubland and meadow. Thirty-two percent of the landuse was residential and the remaining 25 percent of land use consisted of infrastructure and recreational.

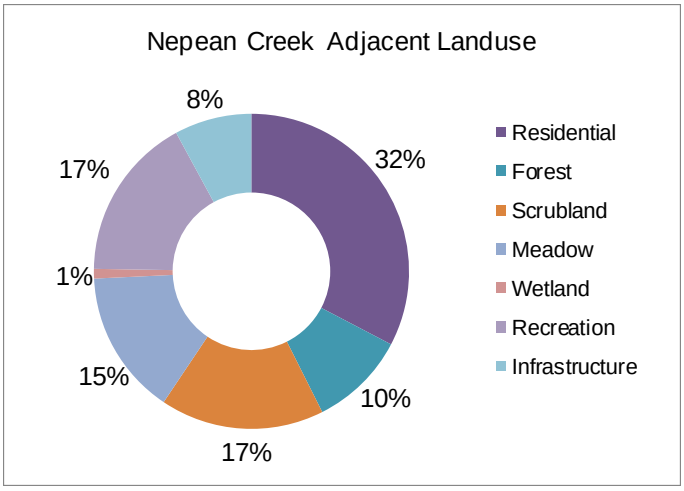

Figure 3. Landuse alongside Nepean Creek

Shoreline Zone

Erosion

Erosion is a normal, important stream process and may not affect actual bank stability; however, excessive erosion and deposition of sediment within a stream can have a detrimental effect on important fish and wildlife habitat. Bank stability indicates how much soil has eroded from the bank into the stream. Poor bank stability can greatly contribute to the amount of sediment carried in a waterbody as well as loss of bank vegetation due to bank failure, resulting in trees falling into the stream and the potential to impact instream migration. Eighty-four percent of the left bank and 89 percent of the right bank was considered stable along Nepean Creek. Figure 4 demonstrates the erosion levels on Nepean Creek. Although overall bank stability was high, most sections had some minor areas of bank instability therefore Figure 4 shows low to moderate levels of erosion throughout most of the creek.

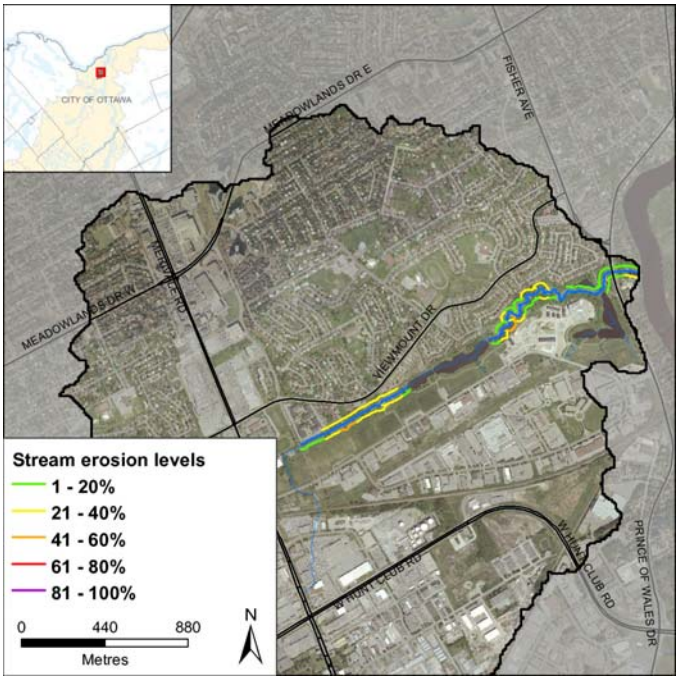

Figure 4. Erosion along Nepean Creek

Streambank Undercutting

Undercut banks are a normal and natural part of stream function and can provide excellent refuge areas for fish. Figure 5 shows that Nepean Creek has some section with heavily undercut stream banks, especially upstream of the online stormwater pond.

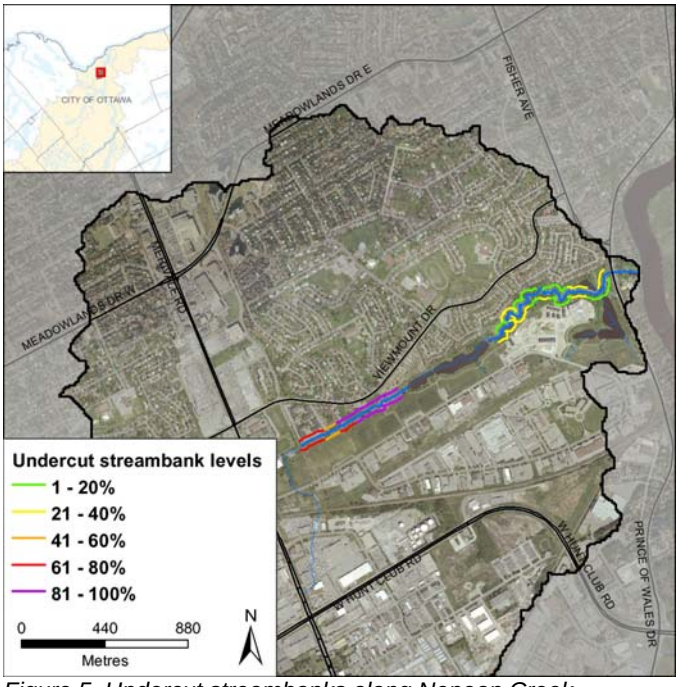

Figure 5. Undercut streambanks along Nepean Creek

Stream Shading

Grasses, shrubs and trees all contribute towards shading a stream. Shade is important in moderating stream temperature, contributing to food supply and helping with nutrient reduction within a stream. Figure 6 shows the stream shading locations along Nepean Creek.

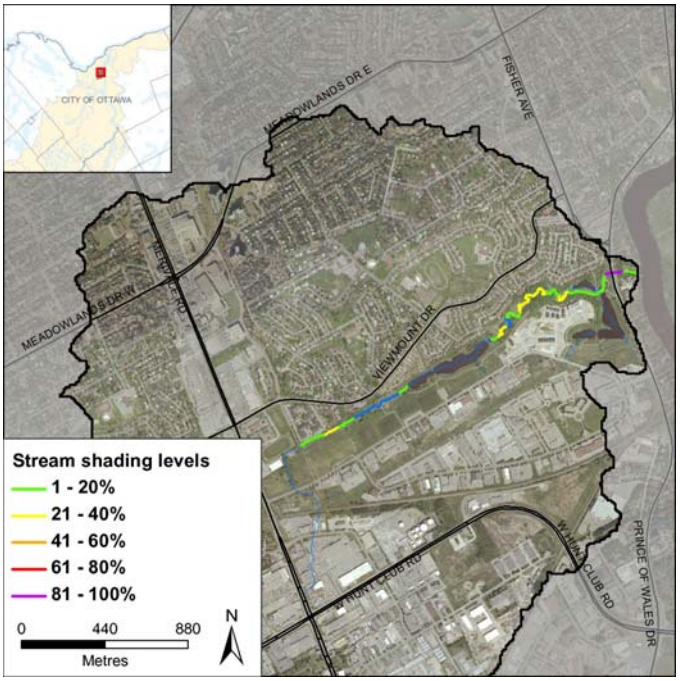

Figure 6. Stream Shading along Nepean Creek

Human Alterations

Figure 7 shows that 25 percent of Nepean Creek remains “unaltered.” Sections considered “natural” with some human changes account for five percent of sections. "Altered" sections accounted for 20 percent of the stream, with the remaining 50 percent of sections sampled being considered “highly altered” (e.g., include road crossings, pedestrian pathway crossings, shoreline/ instream modifications and little or no buffer).

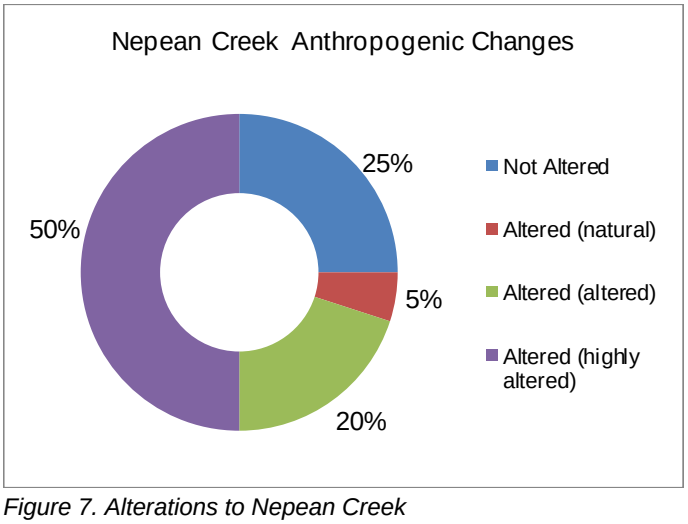

Figure 7. Alterations to Nepean Creek

Overhanging Trees and Branches

Figure 8 shows that the majority of Nepean Creek has relatively low levels of overhanging branches and trees. Overhanging branches and trees provide a food source, nutrients and shade which helps to moderate instream water temperatures.

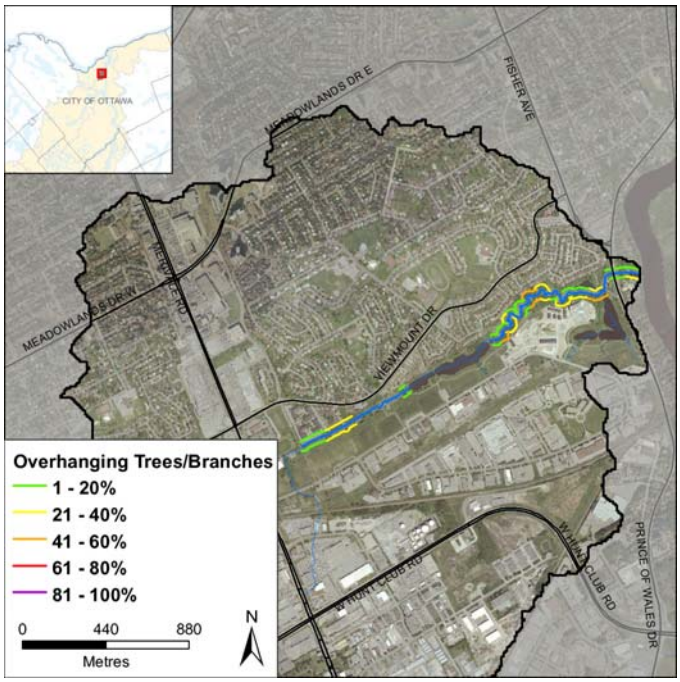

Figure 8. Overhanging trees and branches

Photo 1. Overhanging trees and branches on Nepean Creek

Instream Woody Debris

Figure 9 shows that Nepean Creek has relatively low levels of instream woody debris in the form of branches and trees throughout most of the creek. Instream woody debris is important for fish and benthic habitat, by providing refuge and feeding areas.

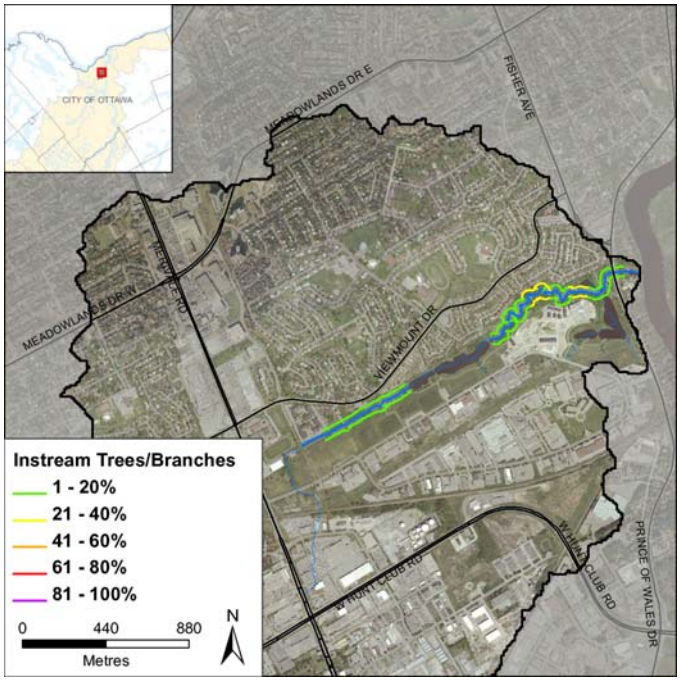

Figure 9. Instream trees and branches

Instream Aquatic Habitat

Habitat Complexity

Streams are naturally meandering systems and move over time. As such, there are varying degrees of habitat complexity depending on the creek. A high percentage of habitat complexity (heterogeneity) typically increases biodiversity of aquatic organisms within a system. Forty-five percent of Nepean Creek was considered heterogeneous as shown in Figure10.

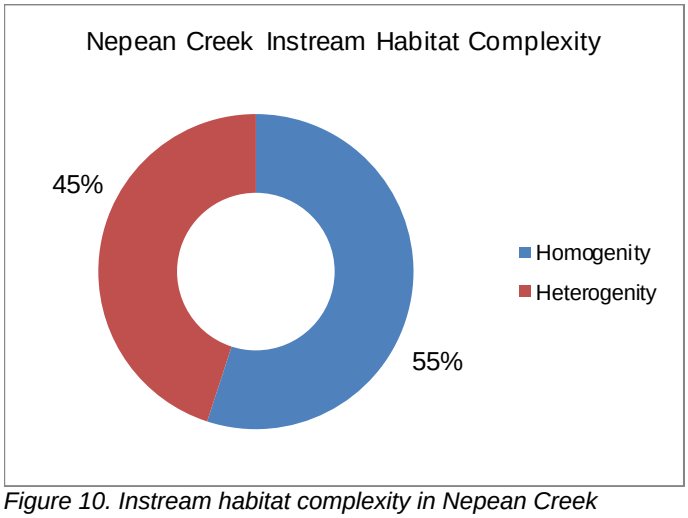

Figure 10. Instream habitat complexity in Nepean Creek

Instream Substrate

Diverse substrate is important for fish and benthic invertebrate habitat because some species have specific substrate requirements and for example will only reproduce on certain types of substrate. Figure 11 demonstrates that the composition of the substrate in Nepean Creek consisted mostly of clay, sand and silt.

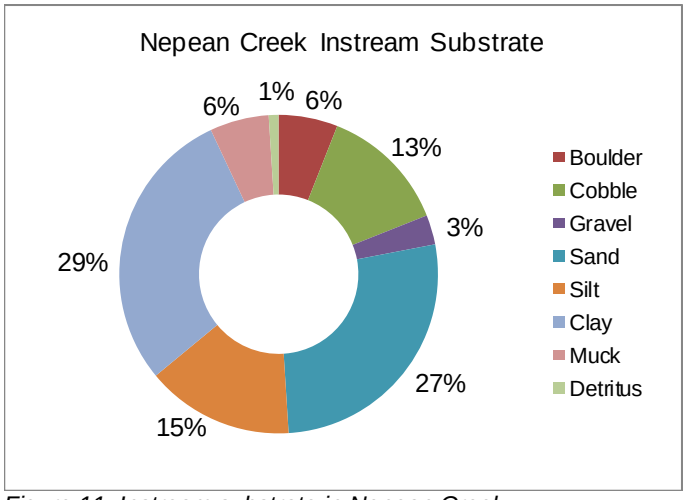

Figure 11. Instream substrate in Nepean Creek

Boulders create instream cover and back eddies for large fish to hide and/or rest out of the current. Cobble provides important over wintering and/or spawning habitat for small or juvenile fish. Cobble can also provide habitat conditions for benthic invertebrates that are a key food source for many fish and wildlife species. Figure 12 shows various locations where cobble and boulder substrate was found in Nepean Creek.

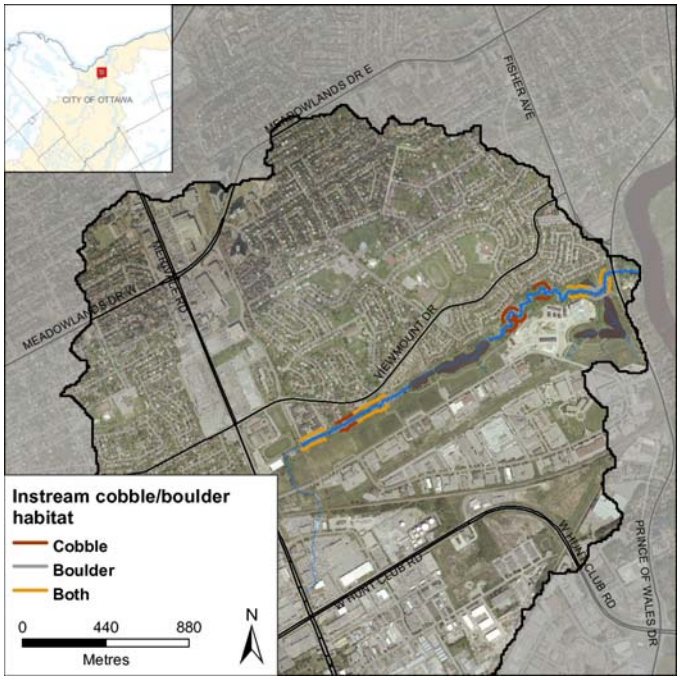

Figure 12. Cobble and boulder habitat along Nepean Creek

Instream Morphology

Pools and riffles are important features for fish habitat. Riffles are areas of agitated water that contribute higher dissolved oxygen to the stream and act as spawning substrate for some species of fish, such as walleye. Pools provide shelter for fish and can be refuge pools in the summer if water levels drop and water temperature in the creek increases. Pools also provide important over wintering areas for fish. Runs are usually moderately shallow, with unagitated surfaces of water and areas where the thalweg (deepest part of the channel) is in the center of the channel. Figure 13 shows that Nepean Creek is fairly uniform; consisting of runs at 85 percent, riffles at six percent and pools at nine percent.

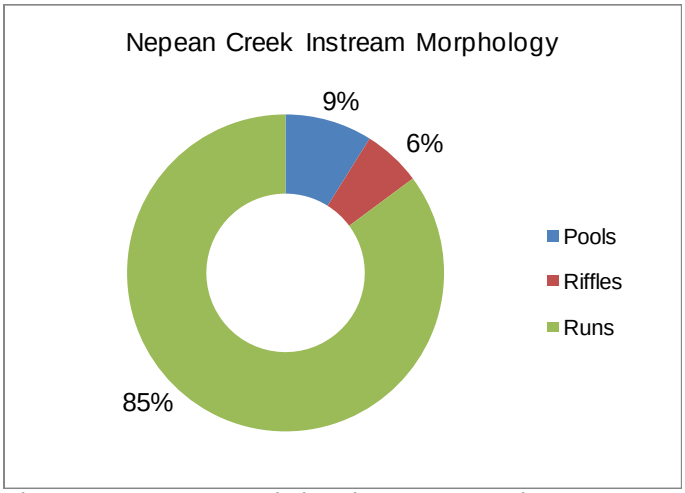

Figure 13. Instream morphology in Nepean Creek

Types of Instream Vegetation

The majority of Nepean Creek has moderate diversity of instream vegetation, as seen in Figure 14. The dominant vegetation type at 57 percent consisted of algae. A total of 19 percent of the vegetation community was recorded as submerged vegetation. Broad-leaved emergent vegetation was recorded at seven percent and narrow emergent vegetation was recorded at six percent. Robust emergents, free-floating and floating vegetation made up the remaining 11 percent of the vegetation community. Volunteers and staff observed that algae was most prominent in the sections of the creek downstream of the stormwater ponds.

Photo 2. Filamentous algae on Nepean Creek downstream from the stormwater pond

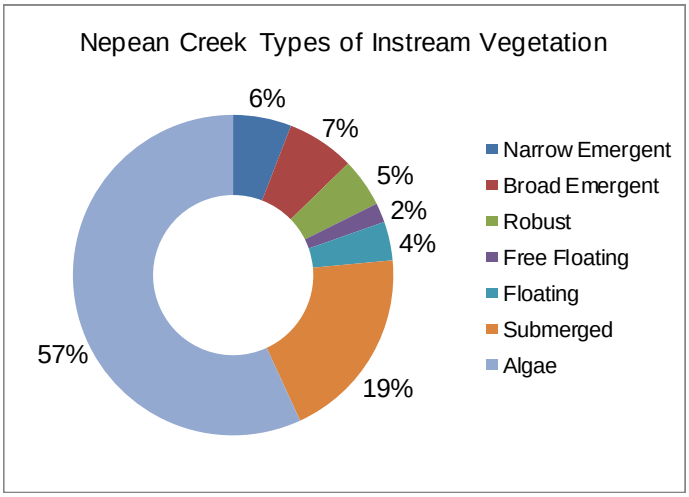

Figure 14. Instream vegetation types in Nepean Creek

Amount of Instream Vegetation

Instream vegetation is an important factor for a healthy stream ecosystem. Vegetation helps to remove contaminants from the water, contributes oxygen to the stream, and provides habitat for fish and wildlife. Too much vegetation can also be detrimental. Figure 15 demonstrates the frequency of instream vegetation in Nepean Creek. Thirty-four percent of the creek had extensive levels of vegetation. Twenty-five percent of the creek had common or normal levels. Forty-one percent had low or rare levels of vegetation.
City Stream Watch staff and volunteers observed that Nepean Creek has the highest levels of instream vegetation in the sections downstream of the stormwater pond, and low levels of vegetation upstream of the stormwater pond.

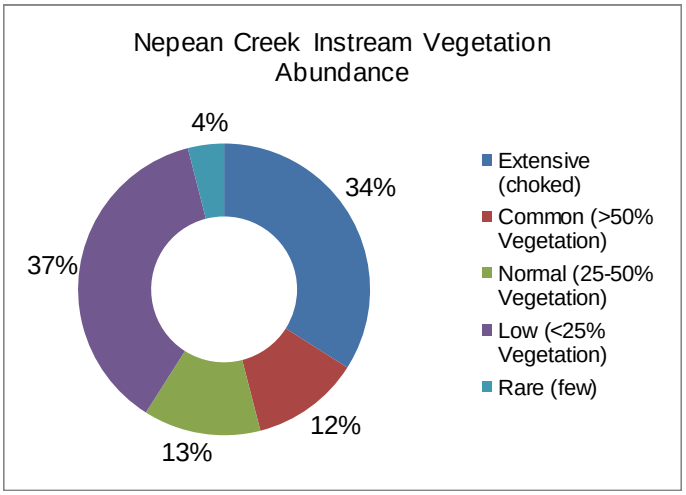

Figure 15. Vegetation abundance in Nepean Creek

Invasive Species

Invasive species can have major implications on streams and species diversity. Invasive species are one of the largest threats to ecosystems throughout Ontario and can outcompete native species, having negative effects on local wildlife, fish and plant populations. In Nepean Creek, invasive species were observed in 90 percent of the sections surveyed, and often more than one species was present in the same area (Figure 16). Chinese mystery snail (*Bellamya chinenses*) was the most prolific invasive species found in large quantities downstream of the stormwater pond. Other species observed in Nepean Creek include purple loosestrife (*Lythrum salicaria)*, garlic mustard (*Alliaria petiolata)*, yellow iris (*Iris pseudacorus*), zebra mussel (*Dreissena polymorpha*), Manitoba maple (*Acer negundo)*, and buckthorn spp (*Rhamnus cathartica)*.

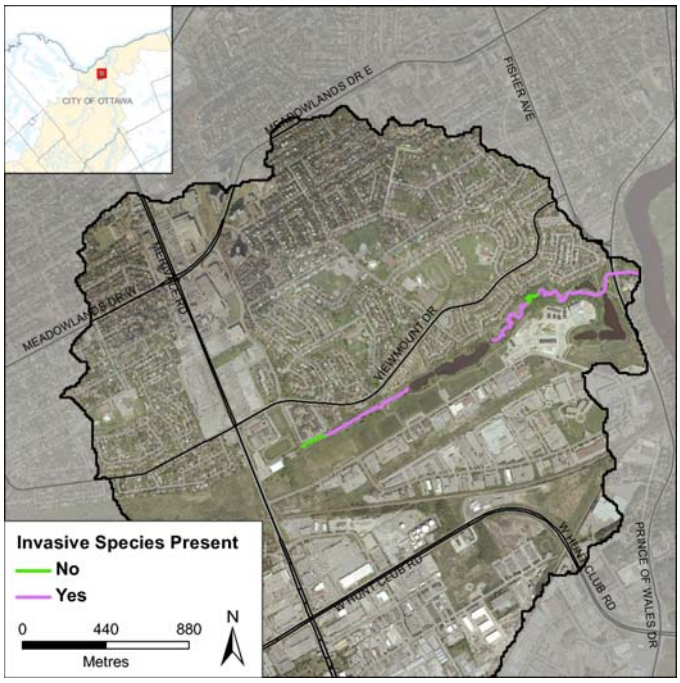

Figure 16. Invasive species along Nepean Creek

Photo 3. Chinese mystery snail (Bellamya chinenses). This invasive species is prolific on Nepean Creek downstream of the stormwater pond.

Wildlife

The diversity of fish and wildlife populations can be an indicator of water quality and overall stream health. Table 5 is a summary of all wildlife observed during stream surveys.

Wildlife	Observed
Birds	wood duck, malard, redwing blackbird, gull, cardinal, robin, cowbird, crow, catbird, goldfinch, grackle, sparrow
Mammals	beaver, muskrat, squirrel, raccoon
Reptiles/Amphibians	green frog, painted turtle, american toad, leopard frog, tadpole, bullfrog
Aquatic Insects	whirlygig beetle, damselfly larva, corixidae sp, crayfish, waterstrider
Other	swallowtail sp., admiral butterfly, monarch, wasp, ladybug, mosquito, Chinese mystery snail, bumblebee, leech, horsefly, clam, crayfish, nematode, deerfly

Table 5. Wildlife observed along Nepean Creek

Pollution

Figure 17 demonstrates the incidence of pollution/ garbage in Nepean Creek. Pollution and garbage in the stream is assessed visually and noted for each section where it is observed. Only ten percent of the sections did not have any observable garbage. Seventy percent had floating garbage, 80 percent had garbage on the stream bottom, five percent had oil/gas trails and 10 percent of the sections had discoloration on the channel bed. High amounts of garbage on the creek are likely due to its close proximity to a highly developed area and its popularity as a recreation destination.

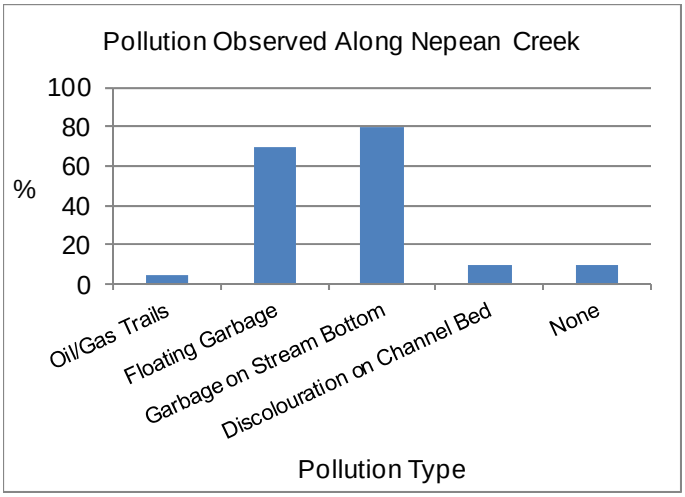

Figure 17. Pollution observed along Nepean Creek

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Figure 18 shows where three temperature dataloggers were deployed in Nepean Creek from April to late September 2012 to give a representative sample of how water temperature fluctuates.

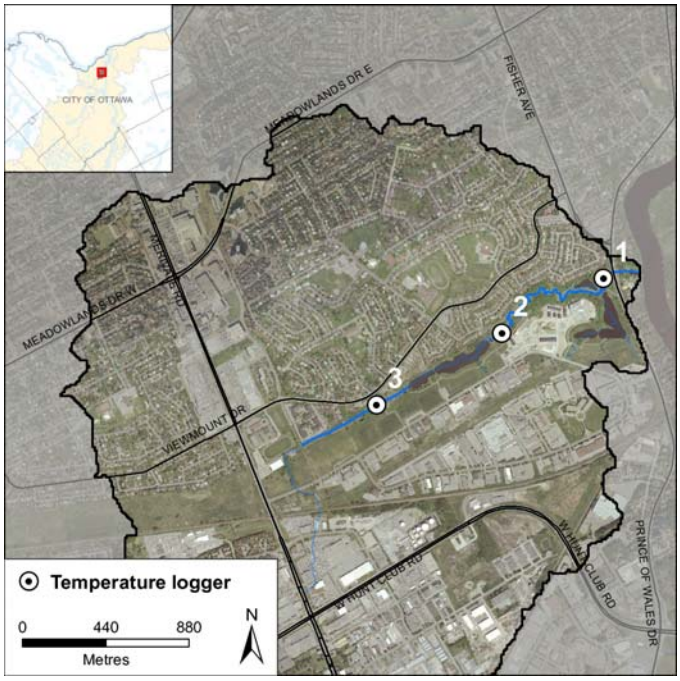

Figure 18. Temperature dataloggers along Nepean Creek

Many factors can influence fluctuations in stream temperature, including springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Water temperature is used along with the maximum air temperature (using the Stoneman and Jones method) to classify a watercourse as either warmwater, coolwater or cold water. Figure 19 shows the thermal classification of Nepean Creek. Analysis of the data collected indicates that Nepean Creek is a warmwater system with coolwater reaches. The coolwater data points are from temperature logger #3 which was located upstream of the stormwater pond closest to where the water emerges from underground piping.

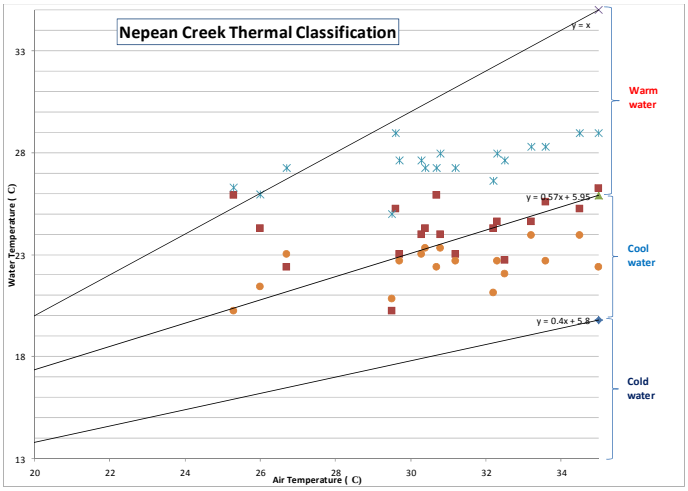

Figure 19. Thermal Classification for Nepean Creek

Fish Sampling

Fish sampling sites located along Nepean Creek are shown in Figure 20. Results are from fish sampling conducted by the Rideau Valley Conservation Authority and the City of Ottawa. The provincial fish codes shown on the map are listed (in Table 6) beside the common name of those fish species identified in Nepean Creek.

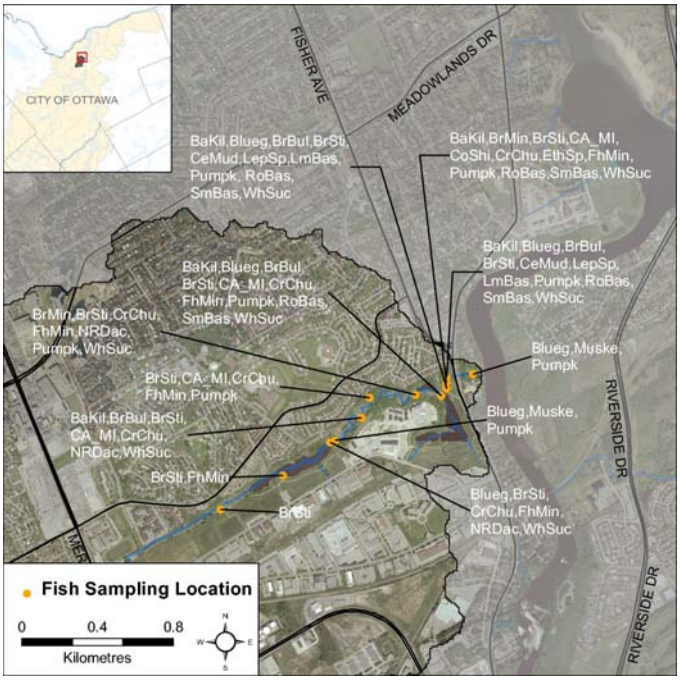

Figure 20. Fish species observed in Nepean Creek

Species Legend			
Bakil	banded killifish	**EthSp**	*Etheostoma sp.*
Blueg	bluegill	**FhMin**	fathead minnow
BrBul	brown bullhead	**LepSp**	*Lepomis sp.*
BrMin	brassy minnow	**Muske**	muskellunge
BrSti	brook stickleback	**NRDac**	Northern redbelly dace
CA_MI	carps and minnows	**Pumpk**	pumpkinseed
CeMud	central mudminnow	**RoBas**	rock bass
CoShi	common shiner	**SmBas**	smallmouth bass
CrChu	creek chub		

Table 6. Fish species observed in Nepean Creek

Photo 4. Brown bullhead caught in Nepean Creek

Migratory Obstructions

It is important to know locations of migratory obstructions because these can prevent fish from accessing important spawning and rearing habitat. Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. Figure 21 shows that Nepean Creek has three migratory obstructions, one being the weir at the end of the online stormwater pond.

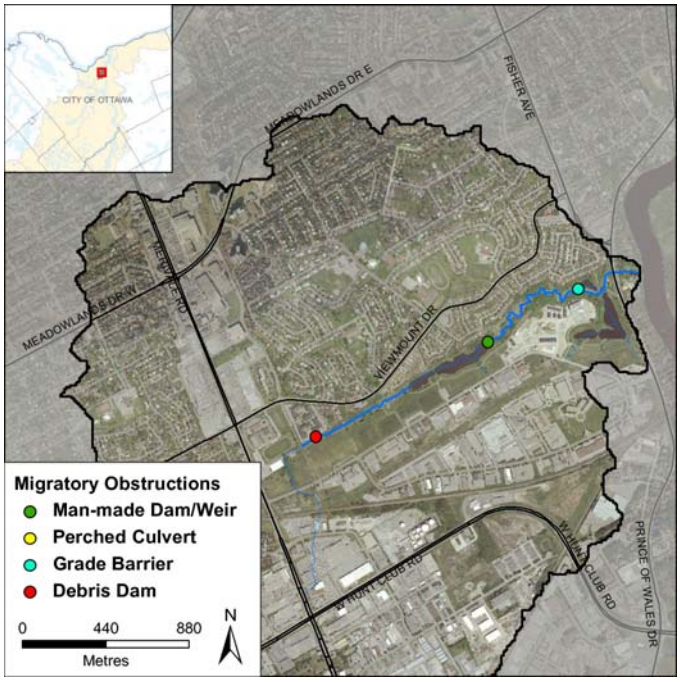

Figure 21. Migratory obstructions in Nepean Creek

Water Chemistry

During the macrostream survey, a YSI probe is used to collect water chemistry, as follows:

- Dissolved Oxygen is a measure of the amount of oxygen dissolved in water. The lowest acceptable concentration of dissolved oxygen is 6.0 mg/L for early stages of warmwater fish and 9.5 mg/L for cold water fish (CCME, 1999). A saturation value of 90 percent or above is considered healthy
- Conductivity is the ability of a substance to transfer electricity. This measure is influenced by the presence of dissolved salts and other ions in the stream 2012
- pH is a measure of relative acidity or alkalinity, ranging from one (most acidic) to 14 (most alkaline/ basic), with seven occupying a neutral point

2012 data for these three parameters is summarized in Table 7.

Month	Range	DO (mg/L)	DO (%)	Conductivity (µs/cm)	pH
May	low	7	80.04	969	8.27
	high	9.04	103.37	1175	8.4
June	low	6.9	74.31	458	7.08
	high	14.13	152.18	2279	8.95
July	low	-	-	-	0
	high	-	-	-	0
August	low	4.34	48.42	385	7.43
	high	8.18	91.26	1595	7.77

Table 7. 2012 Water chemistry collected along Nepean Creek

Photo 5. A volunteer using a YSI on Nepean Creek

Stream Comparison Between 2007 and 2012

The following tables provide a comparison of Nepean Creek between the 2007 and 2012 survey years which gives an indication of how the creek may have changed over time.

Anthropogenic Changes

Table 8 shows that between 2007 and 2012 anthropogenic alterations along Nepean Creek have increased significantly. Some of this change can be attributed to changes in the macro stream protocol that is used. In 2010 anthropogenic alterations were further defined in the protocol, which would have caused some land uses to shift categories.

Anthropogentic Alterations	2007 (%)	2012 (%)
None	n/a	25
"Natural" conditions with minor human alterations	44	5
"Altered" with considerable human impact but significant natural portions	56	20
"Highly altered" by humans with few natural portions	n/a	50

Table 8. Comparison of anthropogenic alterations along Nepean Creek between 2007 and 2012

Bank Stability Changes

According to observations bank stability along Nepean Creek has not changed much since 2007. In 2007, 87 percent of the banks were considered stable. In 2012, 84 percent of the left bank was stable and 89 percent of the right bank was stable.

Bank Stability	2007	2012 Left Bank	2012 Right Bank
Stable	87	84	89
Unstable	13	16	11

Table 9. Comparison of bank stability between 2007 and 2012

Changes in Instream Vegetation

Table 10 shows that there has been a significant increase in instream vegetation in Nepean Creek since 2007. The amount of extensive levels of vegetation has jumped form zero in 2007 to 34 percent in 2012. Areas with rare levels of vegetation have dropped from 39 percent in 2007 to four percent in 2012. Some changes may be attributed to changes in the macro stream protocol, but the significant increase in extensive levels of vegetation suggest that there are high amounts of nutrients entering the system.

Instream Vegetation	2007 (%)	2012 (%)
Extensive	0	34
Common	55	12
Normal	n/a	13
Low	6	37
Rare	39	4
None	n/a	0

Table 10. Comparison of instream vegetation levels between 2007 and 2012

Changes in Pollution and Garbage

Overall the amount of pollution and garbage in Nepean Creek has increased since 2007. Table 11 shows that the number of sections surveyed that were free from garbage has increased slightly since 2007. In addition the number of section with floating garbage has also decreased. However, the number of sections that had garbage on the stream bottom has increased significantly from 17 to 80 percent since 2007.

Pollution/Garbage	2007	2012
None	0	10
Floating Garbage	83	70
Garbage on Stream Bottom	17	80
Oil or Gas Trails	0	5
Discoloration of Channel Bed	n/a	10

Table 11. Comparison of pollution/garbage levels between 2007 and 2012

Monitoring and Restoration

Past Monitoring and Restoration Projects on Nepean Creek

Table 12 highlights the monitoring and restoration work that has been done on Nepean Creek to date by the Rideau Valley Conservation Authority.

Accomplishment	Year	Description
City Stream Watch Monitoring	2007	18 macro stream surveys were completed by City Stream Watch staff and volunteers
City Stream Watch Fish Sampling	2007	Five sites were sampling for fish using a seine net and two sites were sampled for fish using an electrofisher
City Stream Watch Monitoring	2012	20 macro stream surveys were completed by City Stream Watch staff and volunteers
City Stream Watch Fish Sampling	2012	Using and electrofisher, two sites were sampled for fish three times and one site was sampled for fish four times from May to July
City Stream Watch Thermal Classification	2012	Three temperature data loggers were deployed in Nepean Creek from April to September
Riparian Tree Planting (RVCA)	2012	CSW and Shoreline Naturalization staff joined 17 volunteers and multiple Scout Groups to plant 1,500 trees and shrubs along Nepean Creek

Table 12. Monitoring and restoration projects on Nepean Creek

2012 Restoration Activities

Nepean Creek Riparian Planting

Approximately 150 volunteers from a number of Scout groups throughout the Ottawa area turned up to help 17 City Stream Watch volunteers and staff plant a section of Nepean Creek this spring. The 17 CSW volunteers spent 51 hours planting 1,500 trees and shrubs along a section of the creek in Nepean Creek Park/Charmaine Hooper Fields.

Photo 6. Volunteers planting trees along Nepean Creek

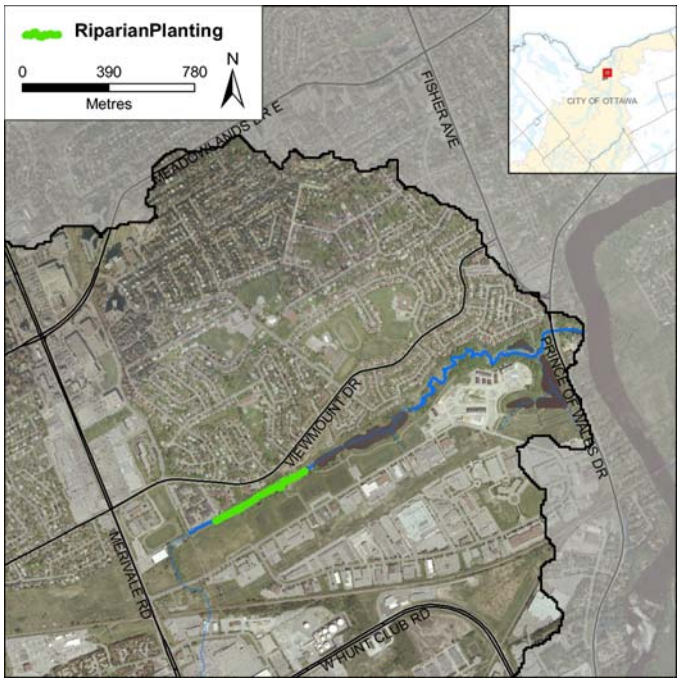

Figure 22. Location of the Nepean Creek riparian planting effort 2012

Potential Riparian Restoration Opportunities

Figure 23 depicts the locations where City Stream Watch staff and volunteers made note of opportunities for future riparian restoration activities.

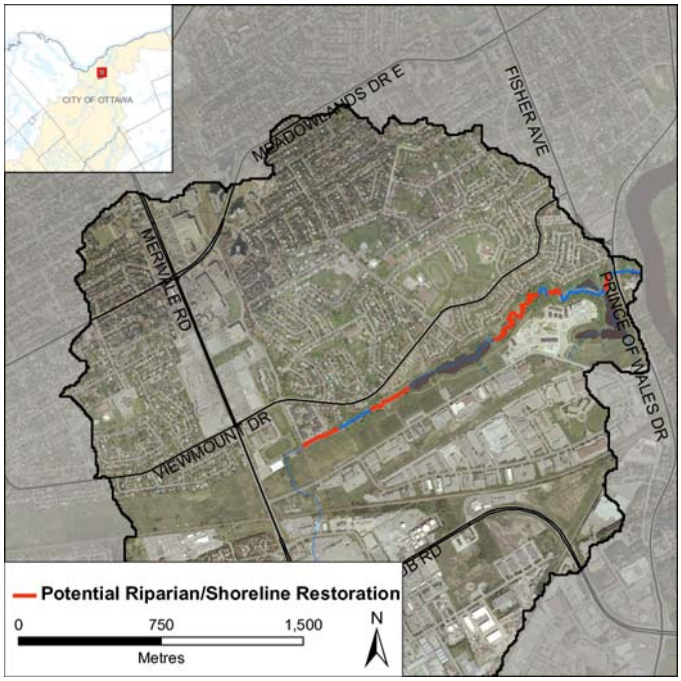

Figure 23. Nepean Creek riparian restoration opportunities

Potential Instream Restoration Opportunities

Figure 24 depicts the locations where various instream restoration activities can be implemented as a result of observations made during the stream survey assessments.

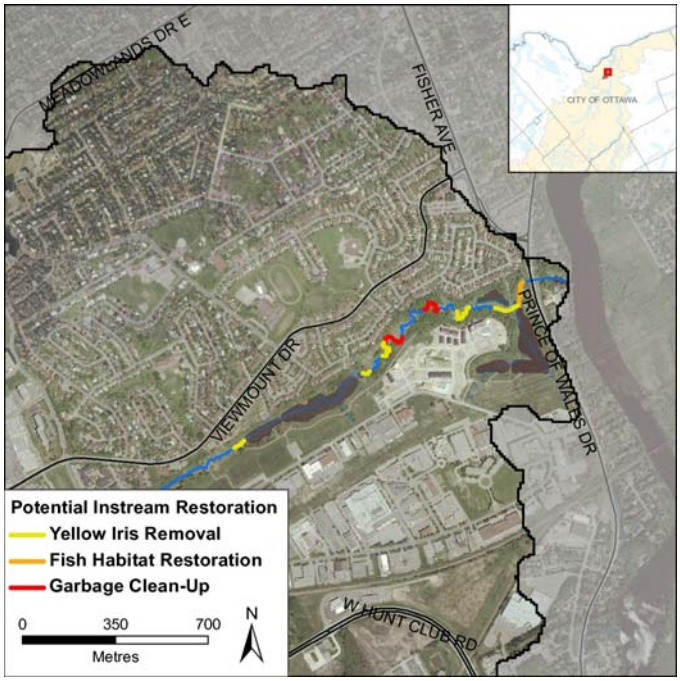

Figure 24. Potential instream restoration opportunities along Nepean Creek

Photo 7. A section of Nepean Creek where riparian planting was identified as a potential restoration opportunity

Photo 8. A section of Nepean Creek where fish habitat creation was identified as a potential instream restoration opportunity



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For more information of the overall 2012 City Stream Watch Program and the volunteer activities, please refer to the City Stream Watch Summary Report 2012.

To view the macrostream protocol used, please see the City Stream Watch website: http://www.rvca.cac/programs/streamwatch/index.html